CLAIMS

What we claim is:

1. A dielectric material comprising elements of Si, C, O, H having a dielectric constant of about 2.8 or less, a tensile stress of less than 45 MPa, an elastic modulus from about 2 to about 15 GPa, and a hardness from about 0.2 to about 2 GPa.

2. The dielectric material of Claim 1 wherein said material has a cohesive strength from about 1.7 to about 4.5 J/m^2.

3. The dielectric material of Claim 1 wherein said material has a crack development velocity in water of not more than $1x10^{-10}$ m/sec for a film thickness from about 1.1 to about 2.8 microns.

4. The dielectric material of Claim 1 wherein the dielectric constant is 2.7, the tensile stress is less than 45 MPa, the elastic modulus is from about 9 to about 15 GPa, and the hardness is from about 0.5 to about 2 GPa.

5. The dielectric material of Claim 4 wherein said material has a cohesive strength from about 4.0 to about 4.5 J/m^2.

6. The dielectric material of Claim 4 wherein said material has a crack development velocity in water of not more than $1x10^{-10}$ m/sec for a film thickness of 2.8 microns.

7. The dielectric material of Claim 1 wherein the dielectric constant is 2.6, the tensile stress is less than 45 MPa, the elastic modulus is from about 8 to about 13 GPa, and the hardness is from about 0.4 to about 1.9 GPa.

8. The dielectric material of Claim 7 wherein the material has a cohesive strength from about 4.0 to about 4.5 J/m^2.

9. The dielectric material of Claim 7 wherein the material has a crack development velocity in water of not more than $1x10^{-10}$ m/sec for a film thickness of 2.7 microns.

10. The dielectric material of Claim 1 wherein the dielectric constant is 2.5, the tensile stress is less than 45 MPa, the elastic modulus is from about 7 to about 12 GPa, and the hardness is from about 0.35 to about 1.8 GPa.

11. The dielectric material of Claim 10 wherein the material has a cohesive strength from about 2.5 to about 3.9 J/m^2.

12. The dielectric material of Claim 10 wherein the material has a crack development velocity in water of not more than $1x10^{-10}$ m/sec for a film thickness of 2.5 microns.

13. The dielectric material of Claim 1 wherein the dielectric constant is 2.4, the tensile stress is less than 40 MPa, the elastic modulus is from about 6 to about 11 GPa, and the hardness is from about 0.3 to about 1.7 GPa.

14. The dielectric material of Claim 13 wherein the material has a cohesive strength from about 2.4 to about 3.8 J/m^2.

15. The dielectric material of Claim 13 wherein said material has a crack development velocity in water of not more than $1x10^{-10}$ m/sec for a film thickness of 2.3 microns.

16. The dielectric material of Claim 1 wherein the dielectric constant is 2.3, the tensile stress is less than 40 MPa, the elastic modulus is from about 5 to about 10 GPa, and the hardness is from about 0.25 to about 1.6 GPa.

17. The dielectric material of Claim 16 wherein material has a cohesive strength from about 2.2 to about 3.7 J/m^2.

18. The dielectric material of Claim 16 wherein said material has a crack development velocity in water of not more than $1x10^{-10}$ m/sec for a film thickness of 1.9 microns.

19. The dielectric material of Claim 1 wherein the dielectric constant is 2.2, the tensile stress is less than 40 MPa, the elastic modulus is from about 4 to about 9 GPa, and the hardness is from about 0.2 to about 1.5 GPa.

20. The dielectric material of Claim 19 wherein the material has a cohesive strength from about 2.0 to about 3.5 J/m^2.

21. The dielectric material of Claim 19 wherein the material has a crack development velocity in water of not more than $1x10^{-10}$ m/sec for a film thickness of 1.5 microns.

22. The dielectric material of Claim 1 wherein the dielectric constant is 2.1, the tensile stress is from about 20 to about 35 MPa, the elastic modulus is from about 3 to about 8 GPa, and the hardness is from about 0.2 to about 1.4 GPa.

23. The dielectric material of Claim 22 wherein the material has a cohesive strength from about 1.8 to about 3.4 J/m^2.

24. The dielectric material of Claim 22 wherein the material has a crack development velocity in water of not more than $1x10^{-10}$ m/sec for a film thickness of 1.3 microns.

25. The dielectric material of Claim 1 wherein the dielectric constant is 2.0, the tensile stress is from about 20 to about 35 MPa, the elastic modulus is from about 2 to about 7 GPa, and the hardness is0.2 GPa.

26. The dielectric material of Claim 25 wherein the material has a cohesive strength is from about 1.7 to about 3.3 J/m^2.

27. The dielectric material of Claim 25 wherein the material has a crack development velocity in water of not more than 1×10^{-10} m/sec for a film thickness of 1.1 microns.

28. The dielectric material of Claim 1 wherein the dielectric material has a covalently bonded tri-dimensional network structure.

29. The dielectric material of Claim 28 wherein said covalently bonded tri-dimensional network structure further comprises Si-O bonds that produce an FTIR absorbance spectrum in which the ratio of the cage Si-O intensity to the network Si-O intensity is decreased using a treatment after deposition.

30. The dielectric material of Claim 29 wherein said treatment uses at least an energy source selected from the group consisting of thermal, chemical, ultraviolet (UV) light, electron beam (e-beam), microwave and plasma.

31. The dielectric material of Claim 1 wherein said material has a water contact angle that is greater than 70°.

32. The dielectric material of Claim 1 wherein said dielectric material further comprises a multiplicity of nanometer-sized pores.

33. An interconnect structure comprising at least a dielectric material comprising elements of Si, C, O, H having a dielectric constant of about 2.8 or less, a tensile stress of less than 45 MPa, an elastic modulus from about 2 to about 15 GPa, and a hardness from about 0.2 to about 2 GPa and wiring regions.

34. The electronic structure of Claim 33 wherein the dielectric constant of the dielectric material is 2.7, the elastic modulus of the dielectric material is from about 9 to about 15 GPa, and the hardness of the dielectric material is from about 0.5 to about 2 GPa.

35. The electronic structure of Claim 33 wherein the dielectric constant of the dielectric material is 2.6, the elastic modulus of the dielectric material is from about 8 to about 13 GPa, and the hardness of the dielectric material is from about 0.4 to about 1.9 GPa.

36. The electronic structure of Claim 33 wherein the dielectric constant of the dielectric material is 2.5, the elastic modulus of the dielectric material is from about 7 to about 12 GPa, and the hardness of the dielectric material is from about 0.35 to about 1.8 GPa.

37. The electronic structure of Claim 33 wherein the dielectric constant of the dielectric material is 2.4, the elastic modulus of the dielectric material is from about 6 to about 11 GPa, and the hardness of the dielectric material is from about 0.3 to about 1.7 GPa.

38. The electronic structure of Claim 33 wherein the dielectric constant of the dielectric material is 2.3, the elastic modulus of the dielectric material is from about 5 to about 10 GPa, and the hardness of the dielectric material is from about 0.25 to about 1.6 GPa.

39. The electronic structure of Claim 33 wherein the dielectric constant of the dielectric material is 2.2, the elastic modulus of the dielectric material is from about 4 to about 9 GPa, and the hardness of the dielectric material is from about 0.2 to about 1.5 GPa.

40. The electronic structure of Claim 33 wherein the dielectric constant of the dielectric material is 2.1, the elastic modulus of the dielectric material is from about 3 to about 8 GPa, and the hardness of the dielectric material is from about 0.2 to about 1.4 GPa.

41. The electronic structure of Claim 33 wherein the dielectric constant of the dielectric material is 2.0, the tensile stress of the dielectric material is from about 20 to about 35 MPa, the elastic modulus of the dielectric material is from about 2 to about 7 GPa, and the hardness of the dielectric material is 0.2 GPa.

42. The electronic structure of Claim 33 wherein said covalently bonded tri-dimensional network structure further comprises Si-O bonds that produce an FTIR absorbance spectrum in which the ratio of the cage Si-O intensity to the network Si-O intensity is decreased using a treatment after deposition.

43. The electronic structure of Claim 42 wherein the dielectric material has a covalently bonded tri-dimensional network structure.

44. The electronic structure of Claim 42 wherein said treatment uses at least an energy source selected from the group consisting of thermal, chemical, ultraviolet (UV) light, electron beam (e-beam), microwave and plasma.

45. The electronic structure of Claim 33 wherein the dielectric material has a water contact angle of greater than 70°.

46. The electronic structure of Claim 33 wherein said dielectric material further comprises a multiplicity of nanometer-sized pores.

47. A method of fabricating a SiCOH dielectric material comprising:

providing at least a first precursor containing atoms of Si, C, O and H and an inert carrier into a reactor; and

depositing a film derived from said first precursor onto a substrate by selecting conditions that are effective in providing a SiCOH dielectric having dielectric constant of about 2.8 or less, a tensile stress of less than 40 MPa, an elastic modulus from about 2 to about 15 GPa, and a hardness from about 0.2 to about 2 GPa.

48. The method of Claim 47 wherein said first precursor comprises, 3, 5, 7-tetramethylcyclotetrasiloxane, octamethylcyclotetrasiloxane, diethoxymethylsilane (DEMS), dimethyldimethoxysilane (DMDMOS), diethyldimethoxysilane (DEDMOS), and related cyclic and non-cyclic silanes, or siloxanes.

49. The method of Claim 47 further comprising a second precursor, said second precursor comprises a hydrocarbon molecule selected from the group consisting of molecules with ring structures and molecules containing branched tertiary butyl or isopropyl groups attached to a hydrocarbon ring.

50. The method of Claim 49 wherein said second precursor is a hydrocarbon molecule containing oxygen.

51. The method of Claim 49 wherein said second precursor is cyclopentene oxide.

52. The method of Claim 47 further comprising a third precursor, said third precursor is germane hydride or any other reactant comprising a source Ge.

53. The method of Claim 47 further comprising providing an oxidizing agent to said reactor.

54. The method of Claim 47 further comprising exposing the dielectric material to at least one energy source.

55. The method of Claim 53 wherein the at least one energy source is a thermal energy source, UV light, electron beam, chemical, microwave or plasma.

56. The method of Claim 53 wherein the at least one energy source is UV light and said exposing is performed at a substrate temperature from 300° – 450°C, and a wavelength between 150 – 370 nm.

57. The method of Claim 56 wherein the wavelength is between 190 – 290 nm.